NEWS RELEASE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
400 MARYLAND AVENUE, SW, WASHINGTON 25, D.C.
TELEPHONES: WORTH 2-4155 —— WORTH 3-1110

FOR RELEASE: Upon Delivery

RELEASE NO. 62-34

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National Aeronautics and Space Administration
for delivery at the Annual Convention, American
Association of School Administrators
Atlantic City, New Jersey
February 18, 1962

ACCELERATED SPACE EXPLORATION: AN IMPERATIVE FOR AMERICANS

Space science and space exploration have become an integral and vital part of a great industrial and technological revolution which is now taking place in our own country and throughout the world. This revolution is of such great dimensions and is developing at such a rapid pace that to cope with it is making the most extraordinary demands upon our mental, emotional, physical and financial capabilities. The pace itself, already incredibly fast, is accelerating. This rapid rate of change as much as the change itself is one of the dominant facts of our time.

In one average life span, we have experienced several so-called "ages." For example, the Air Age, the Age of Creative Chemistry, the Age of Synthetics, the Atomic Age, and presently, the Space Age. As these informal, catchy and loosely placed time-labels indicate, the years of this Century have been and are to be marked by unprecedented scientific advancement and technological development.

Historically, whenever we have experienced a significant innovation, we have also experienced great changes in our patterns for living -- changes induced by this same innovation. A good example is the development of the airplane as an efficient carrier of men and goods at speeds undreamed of in our earth-bound days, shrinking the globe and putting all nations into close proximity for air war or air commerce. Another is the harnessing of nuclear energy, and all its implications for destruction or beneficence.

As we reach out into space, probing its mysteries, we again are experiencing profound changes induced by space science and technology. We are priming a tremendous tide of scientific and technological creativity as we reach into space with probes and satellites, and as we prepare to send men to orbit and land on the moon.

The U. S. space program has from the beginning had four general objectives. These are (1) to study the space environment by scientific instruments of many types launched into space by sounding rockets, space probes, earth satellites, and artificial planets; (2) to begin the exploration of space and the solar system by man himself; (3) to apply space science and technology to the development of earth satellites for peaceful purposes to promote human welfare; and (4) to apply space science and technology in support of military purposes for national defense and security.

Some major aims of space science are (1) to study the earth and its atmosphere and the influence of the sun upon the earth; (2) to study the nature of the solar system, including the conditions on the sun, moon and planets, and phenomena in interplanetary space; (3) to search for the possible existence of plant or animal life or life-related substances in the solar system; and (4) to contribute to man's understanding of the origin and nature of the universe as a whole.

These, briefly, are some aims and objectives of our national space program. Some of the pertinent details about our progress to date and about our plans for the future will be given to you further on in this NASA presentation.

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Why, you may ask, should the United States spend the billions necessary for the exploration of space? Since this has become a much debated question, let me try to answer it under some headings that will help to simplify the necessarily complex answer.

These headings are:

1. The Quest for Scientific Knowledge.

2. Practical Applications and Values.

3. Economic Values and Implications.

4. National Stature and Prestige.

5. National Security.

Let's start with No. 1, The Quest for Scientific Knowledge.

The continuous search for scientific knowledge is a major objective of the NASA program. Our manned and unmanned lunar exploration is a giant step, but only a step, toward the exploration of our solar-system, and later, of our universe.

Scientists estimate that the solar system was formed about 4.5 billion years ago, but we don't yet know how it was formed. The moon, with its relative lack of atmosphere and gravity is thought to hold answers to many questions of the origin and evolution of our life on planet Earth, and provide far greater scientific knowledge than we now possess about the universe.

The NASA program of space science is carried out in many universities, as well as in our NASA laboratories and in industry. Its strong thrust is in basic research. The scientists who are participating in the program are motivated by disciplined curiosity which leads them to explore, to probe, to investigate and to measure as many as possible of the phenomena of the universe. To them the tremendous breadth and scope of space science is stimulating and exciting, and it affords an unusual opportunity to attempt solutions to the most important and fundamental problems of the frontiers of science today.

This thirst for knowledge through space science is inseparable from all the rest of science carried out on the earth. It is interesting and important to note than many scientific disciplines that have in the past gone their separate ways with only mild interactions, now tackle in close partnership the problem of understanding the phenomena of outer space. For example, physics, astronomy, and geophysics are drawn together to investigate the increasingly important area of earth-sun relationships.

In the few short years since orbiting our first satellite, we have already gained much new information about our earth and our solar system. For example: The discovery of the two intense Van Allen Radiation Bands in space around the earth; acquisition of data basic to the mapping of the magnetic fields girdling the earth; indications that part of the interplanetary magnetic field near the earth may be an extension of the sun's magnetic field; the determination that the earth is pear-shaped, with the stem end at the North Pole; and the increased understanding of the effects of solar events, including flares, upon our upper atmosphere and upon our weather.

Much of this earlier information was gained through use of satellites which of necessity had to be relatively small because of launch vehicle limitations. We are now developing launch vehicles with greatly improved load-carrying capability. These will enable us to orbit substantially larger and more useful advanced scientific satellites such as the Orbiting Solar Observatory, the Orbiting Astronomical Observatory, and the Orbiting Geophysical Observatory and others which will be described in the presentation to follow, along with NASA projects for extending our exploration to the moon and beyond.

The objective of acquiring new knowledge extends, of course, to the area of space biology. Our Biosciences Program is designed to search for extra-terrestial life and to study the effects that strange environments, particularly those of space and the planets, have on living organisms. These activities involve the search for answers to several questions which have been in the minds of men throughout the ages. Is there life on other planets of the solar system or elsewhere in the galaxies? Is there organic matter on the moon? Are there living micro-organisms beneath the surface of the moon? How did organic matter -- nucleic acids, genes, protoplasm, cells, and life itself -- originate? What effect does space radiation have on biological materials? What are the peculiar effects of zero "g" -- the lack of gravity -- on life phenomena, such as cell division, plant growth, fertilization, photosynthesis, chemical and physical processes? The answers to such questions will have profound impacts on science as a whole, and upon our national and individual philosophies. Hopefully, they may add materially to the overall betterment of the conditions under which man lives on earth. Perhaps we can even expect such findings to improve man himself.

The study of life in space is both of scientific interest and a much needed support to the man-in-space program.

Project Mercury is well known to you. We, in NASA, are proud of the results achieved in this manned space flight program. It has been our intention to launch a manned satellite into a controlled three-orbit flight about 100 miles above the earth, and bring it back safely to earth. Our accomplishments to date have been purposely well-publicized, and their scientific and technical results are available to the world's scientific community. This is American "openness."

We are actively moving on a follow-on to the Project Mercury which involves a larger spacecraft capable of more extensive space flight operation. This is Project Gemini, which has three major objectives: (1) operational space flight experience with two men; (2) orbital flights of up to one week duration; and (3) the attainment of rendezvous technology and operational experience.

You will recall that in his May 25, 1961, State of the Union message, President Kennedy said: "Now is the time to act, to take longer strides . . . time for a great new American enterprise . . . time for this nation to take a clearly leading role in space achievement. I believe that the nation should commit itself to achieving the goal, before the decade is out, of landing on the moon."

This call to action has been heeded. The National space program is accelerating, and before the end of 1970, we plan to land a scientist-astronaut team on the moon, and then return them safely to earth with invaluable additions to our knowledge of the universe.

Our program for taking exploration teams to the moon is Project Apollo. Very shortly you will hear more about our manned space programs and see slides describing them in some detail.

We believe that although instruments aboard unmanned probes and satellites can perform many tasks of sensing and transmitting statistical information gathered in space, men are necessary in space expeditions for understanding and projecting lines of inquiry to reveal the larger realities. The most advanced apparatus can perform only as it is designed. Instruments have little flexivility to meet unforeseen situations. For best results in space exploration, scientific measurements acquired by instruments must be balanced by on-the-spot human senses, human reasoning, and by the power of judgment compounded by these human elements. This is why man, as well as instruments, must venture into space.

Let me turn now to the Practical Applications and Values that arise from active programs of space science and technology.

It is general knowledge that any major advance toward a braod technological goal pays dividends in virtually all scientific and engineering fields. Already our national investment in space exploration has provided new metals, alloys, fabrics, compounds and other materials which have gone into commercial production. These space-related developments constitute the practical values of our space program. The stimulus, the knowledge and the products which are evolving from the program to land Americans on the moon are creating a technology that is certain to radiate great and diversified benefits to almost every area of material and intellectual activity.

I would like to elaborate on this point. Since every pound of equipment to be lifted in a satellite or space probe requires for launching many times as much weight in fuel and rocket engine poundage, great efforts have been made to build the components smaller and smaller, and yet more reliable and effective. This shrinking of electronic parts and of other required components--so-called micro-miniaturization--lays down demanding requirements for lighter, more rugged, and more sophisticated materials and mechnaisms. From this space-related research and development is coming an ever-increasing flow of products which have every-day, down-to-earth applications. Already we have tiny hearing aids, midget radios, portable television sets, and remarkable equipment with medical application possibilities.

We have pin-point size bearings making possible new air-turbine drills for use in dentistry. Miniscule batteries devised to operate satellite instruments are showing up in flashlights, hearing aids and radios; are even used in a heart stimulator which has been inserted by doctors into the bodies of people with faulty hearts. They are being used experimentally to power artificial larynxes that enable the voiceless to speak. They also are being surgically implanted to restore hearing to the totally deaf. These are a few of many items on a growing list of useful developments which are by-products of the national space effort. Better products in such diverse fields as making steel, and freezing ice cream results directly from our space technology developments.

I mentioned the necessity for great accuracy and precision in the components aboard spacecraft. To understand more fully the degree of precision required in space technology, visualize a dime at a point 23 miles from here. Now consider two lines, one touching the top and the other the bottom of the dime. If you visualize the lines joined together where I stand, 23 miles away, you have a graphic mental picture of the kind of precision involved. The angle formed by the lines represents a tenth of a second of arc. It's like cutting a dime-sized pie into 12,960,000 pieces, one of which represents the permissible variation of accuracy in certain aspects of space technology.

Two outstanding practical uses of earth satellites are presently emerging. Meteorological and communications satellite experiments promise to lead to vastly improved weather forecasting services and to greatly expanded global communications.

NASA's Project Echo (the 100 foot "passive" aluminized balloon satellite many of you have seen pass overhead) has demonstrated that such satellites can be used to reflect teleradio and television signals. The "active repeater" experimental satellite, Project Relay, will orbit between 3000 and 8000 miles altitude, and with its electronic instruments, will receive messages from one continent and relay them back down to the earth at the desired terminal points on another continent. An experimental project called Syncom will also involve "active repeater" satellites placed in 22,300 mile orbital altitudes around the earth's equator, synchronous with the rotation of the earth and stationary with respect to desired relay points on the earth. In another space communications project, the American Telephone and Telegraph Company is designing and building "telstar" communication satellites, at its own expense, for two experimental launchings and operations during 1962. NASA will furnish the rocket and the launching and tracking facilities, and will be reimbursed for the costs involved.

Such satellite systems will have much greater capacity than conventional transcontinental and transoceanic teleradio and cable systems. These new systems should produce better and less expensive global communications than present methods.

NASA's meteorological satellites, Tiros I, II, III, and IV have already been orbited and have transmitted thousands of television pictures of the earth's cloud patterns taken from above the weather and have made measurements of the earth's heat and its atmosphere. These weather satellites are the first step in aiding us to understand better the atmospheric processes which produce our weather and climatic changes. At present our meteorological observations from the earth and sounding rockets projected into high atmospheric altitudes can only provide us with about a 20 to 30 percent coverage of weather phenomena, mostly from the underside of the atmosphere and the space surrounding the earth rather than from the vantage point of outer space itself. The Tiros experimental satellite cameras already have detected and transmitted pictures of cyclonic storms and hurricanes as much as a few days before hurricane-hunter airplanes, ground based radar and other conventional instruments could flash the warning signs to the weather forecasters for the saving of life and property. The experimental feats of the meteorological satellites also may well augur the time when the increase in the rapidity and accuracy of short-range and long-range weather forecasting will lead to untold benefits to mankind in agriculture and commerce. Such improvements in weather forecasting and in knowledge about what produces our climatic changes could also have many political and economic implications. In addition, such meteorological satellites may aid eventually in bringing about reliable and large-scale methods of weather modification and control.

In order to keep men alive in space they must have food and water, and yet large and heavy quantities are not feasible because of weight factors. Hence, in space research there have been advances in food preparations, their storage and preservation. Research on the food a human needs for space flight will most probably lead to improved nutrition for those on earth. The development of new foods could prove invaluable as the world's population expands and the demand for food multiplies. Actually, great strides are being made in the effective preparation of foods for canning and freezing through infra-red blanching.

The search for ways to reuse water aboard manned spacecraft is pointing the way toward solving our water shortage problems in some areas caught in the wake of exploding populations. Space research on water recycling may speed the answer, for instance, to the economical desalting of sea water.

Telemetry, the combination of the more-common radio and radar, is used to track satellites and space probes, to transmit and receive information, and to control space devices by remote control. Vital to the space program, telemetry also is hard at work on nonspace problems. One clinic in Detroit has installed a telemetering system to monitor about 30 patients, reducing materially the normal ratio of nurses needed for such activity. The University of North Carolina School of Medicine is using telemetry in open-heart surgery, to indicate the moment-by-moment condition of the patient during the operation, and also to monitor the patient's progress after the operation. Telemetry is proving highly useful in the shipping industry and steel mills, measuring heat build-up in experimental engines, measuring and reporting flow in pipe lines, and in a host of other situations.

Compact power sources that will operate reliably over long periods of time are important for all our spacecraft. Development of these has led to sun-powered batteries, solar cells, fuel cells, lightweight atomic reactors and other relatively small sources of power for instruments and telemetry equipment.

The solar cell, taking energy from the sun, is a principal source of power for many of our scientific satellites such as Pioneer V, Tiros I, II, and III, and others.

The SNAP-2 (Space Nuclear Auxiliary Power) nuclear reactor, weighing only 200 pounds, can generate as much electricity as 500,000 pounds of ordinary chemical storage batteries.

On earth, new power developments such as these can be of great value in remote areas--for use with radio beacons and communications stations, and will be easily transportable in emergency situations. It has been speculated that power sources developed for space flight may replace other sources for many earthbound uses.

The number and nature of practical results are largely unforeseeable, primarily, because they develope on broad fronts, and, frequently, in unsuspected places and directions. Furthermore, the concentration of effort required in our space program does not diminish efforts expended on other frontiers of knowledge, but rather spurs such activities. There are indications that the space program may help fight against cancer by advances in medical instrumentation and by research in bioastronautics. Fields of activity such as oceanography, geophysics, and the physics of high-energy particles have all been given great stimulation as a result of our serious and enlarged space program.

Now, I would like to touch briefly on Economic Values and Implications. The technology we are developing to explore space will be of immense and growing benefit to the economy. As this new space industry expands, it will create new jobs, taking up some of the slack caused by automation. There are over 5,000 industrial and research organizations engaged in civilian and military space-related programs. More than 3,200 different space-related products have been developed thus far. It is important to note that the dollars involved in the effort to place a team of scientists and explorers on the moon will be spent, not on the moon, but right here on earth...in our laboratories, shops and factories.

Now, with respect to space and our National Stature and Prestige. We are in competition with just about every aspect of the Communist way of life and unless we compete strongly, ably and successfully with the Soviet Union in space activities and the underlying technologies, our national prestige will suffer in the eyes of other nations. The people in these countries are equating space successes and the leadership of the future. Space achievements are a symbol of tomorrow's scientific and technical supremacy. Hence, it is important, as a device of foreign policy and diplomacy, to establish a definite position of leadership in order to increase the regard in which we are held internationally. In addition to the overall effects resulting from steady, continuous progress and achievements in our space efforts there is the impact of dramatic "firsts." It is by these "firsts" that the relative progress of Russia and the United States is most often measured by the average person the world around. To some extent even specifically trained scientific and technical minds are influenced by the often superficial but stimulating "firsts."

Typical of the dramatic world "first" still to be accomplished are spacecraft rendezvous; manned flight to the moon; unmanned spacecraft orbit of Mars and return to earth; world-wide communications via space, including trans-oceanic television, and establishment of effective world-wide weather forecasting based on satellite systems.

Each of these is attainable in our national space program, and can be most effective in a prestige sense. To accomplish them first will pay us important dividends in the regard of the large numbers of the world's peoples who are strongly influenced by such primacy.

Now, in touching on National Security let me make clear that I do not feel it is my proper role to speak about military space missions. However, I can state as an important fact that there is a willing and ready interchange of components and vehicles between our military and nonmilitary programs. And I believe that if we allow the Russians to surpass us, their space technology in its military aspects will be used to jeopardize our national security. As Vice President Johnson said in an address to the American Rocket Society in New York last October 14, "We are developing peaceful uses of outer space from choice, but we are working on military uses of outer space from necessity."

This concludes my discussion of the five principal motivations for continuing, on an accelerated basis, to explore space. You have been very patient and now I feel you deserve to get the promised description of some of the major NASA projects and plans for the future from one of my colleagues--Mr. D. D. Wyatt, Director of the NASA Office of Programs. Mr. Wyatt:

Mr. Wyatt's remarks (extemporaneous)

Mr. Webb

This fine overview of our national space program by Mr. Wyatt points up the tremendous scope of the NASA activities. They cut across all disciplinary lines, and represent a massive team effort involving industry, labor, education, and government.

The NASA has the responsibility for providing the educational information resources necessary for adequate development of public understanding of the role of the United States in space exploration for peaceful purposes. We also feel that we have an obligation to create a national awareness of the need to seek out and assist students who have an aptitude for an an interest in preparing for careers in space sciences. We depend upon the nation's educational institutions to provide trained personnel to carry on space and space-related programs. But we also look to academic institutions for strong contributions to our scientific and technological efforts. Currently NASA has contracts and grants in excess of $20 million with over 60 different universities for advanced research and development activities. By action such as this we hope to support and help the schools and colleges in their efforts to build strong basic educational programs that are essential to our national progress. We want to deal with this subject at some length here today, but I'm just going to be the kickoff man. To get you deeper into the subject of NASA relations with the education community I'm now going to turn to one of the young men newly come to our agency -- a scientifically trained educator turned Government administrator -- or NASA Assistant Administrator for Public Affairs, Dr. Hiden T. Cox. It is my pleasure to call upon Dr. Cox for a few words about the educational implications of space exploration and the educational programs and services of NASA.

Dr. Cox's Remarks

Science and technology are having, and will continue to have, an increasing influence on our culture and space science and technology have become the catalyst of the rapid rate of change described earlier by Mr. Webb.

Controversies over educational philosophies have existed throughout the ages of our nation and the world. In the 1930's there was a shift from the emphasis upon the three "R's" in the direction of the so-called "social or life adjustment" philosophy. This trend continued until the post World War II period, but the farther it went the more resistance it met. Nevertheless, it took the impact of the supposedly backward Russians splitting the atom and putting its energy into weapons of war, and placing a Sputnik in earth orbit in space to point up the need for some dramatic actions as well as thoughts about our educational philosophy and practices. I point to this only in passing, for it is not my intention to preach the support of one approach over another. Frankly, the disputes about "social or life" adjustments versus increased academic offerings in our schools appear in truth to be themselves academic. What we really need is a mature effort to improve our entire undermanned, inadequately-equipped, and over-burdened school systems all the way from kindergarten through college. Much has been done in the past few years, but much remains to be done. As we have taken steps toward reaching the national goal of a stronger educational program, improved science education has changed from just a hope to an imperative. A generation ago Alfred North Whitehead of Harvard University made a most prophetic statement when he said:

> "In the conditions of modern life, the rule is absolute, the race which does not value trained intelligence is doomed. Not all your heroism, not all your social charm, not all your wit, not all your victories on land, or at sea, can move back the finger of fate. Today we maintain ourselves. Tomorrow science will have moved forward yet one more step and there will be no appeal from the judgment which will then be pronounced on the uneducated."

These words crystallize new attention upon old problems which have long faced education in general and science education in particular. What, exactly, comprises an education which is designed to meet the needs and challenges of our modern culture in which science and technology are playing an increasingly dominant role? What must be done to assure that our schools produce more and better trained young men and women to become the inspired scientists and engineers of tomorrow? What can our schools do to assure that all the graduates possess the necessary level of scientific literacy to cope with the new culture?

The answers are being sought. Many studies have been made, and many projects undertaken to improve the science and mathematics curricula and to improve the teaching-learning situation. These are well known to this audience. The role of the NSF in supporting and encouraging a number of these projects cannot be overemphasized.

In broad terms, I feel we all can agree that an education should give a child spirtual, emotional, and intellectual balance. It should provide him the opportunities for growth in these areas, and for growth and development of his knowledge and his ability to reason.

The artificial separation between liberal arts and a scientific education should be removed. Dr. Robert F. Goheen, President of Princeton, has defined a liberal education as one which liberates the mind. Our culture is the sum total of our knowledge and experience in the arts and in the sciences. A knowledge of the universe in which we live is certainly an important part of that culture.

We should, I believe, attempt to teach what science means, and the importance of experimentation as a means of increasing our knowledge and understanding. Young people should be made to recognize early in life that all our material progress is dependent upon our ability to experiment and to learn from such experimentation. In this regard Einstein said: "Pure logical thinking cannot yield us any knowledge of the empirical world; all knowledge of reality starts from experience and ends in it. Propositions arrived at by purely logical means are completely empty as regards reality."

The pace of our space program cannot continue, much less accelerate, without the enthusiastic support of the country's educational institutions and professional organizations at all levels -- elementary, secondary, undergraduate and graduate. We in the National Aeronautics and Space Administration have especially strong feelings for the importance of developing the talent among the young people who exhibit interest and apitudes in the sciences.

We do not want, however, our schools, colleges and universities to produce for us specially-educated and trained "space scientists" or "space engineers". We would be distressed to see exploration of so-called space science at the expense of weakening our national efforts in other scientific and cultural endeavors. The national space program embracing space exploration and the associated technology is, and should continue to be, a part of a well-balanced national effort in all science and, technology, the social sciences and the humanities.

Most students entering college are not headed toward careers in science or engineering. The majority of them will not need the highly specialized knowledge required by those who plan to become professional scientists. But again, they should all have a comprehending knowledge of science and mathematics, primarily because of the nature of our times.

Our teachers have a great opportunity to help all students to achieve basic understandings of scientific principles, methods, terminology and the place of science in modern life. This is a most difficult objective, of course, but I believe that science, properly presented, can be made a living part of a liberal education. I believe that science discussions can be enhanced by capitalizing upon the natural interests of most people in the challenges of our times -- for example, in space exploration.

The National Aeronautics and Space Administration has been developing an educational services program designed to assist schools, colleges, and the public to meet the needs of education in and for the Space Age. I should like to emphasize the word "service," for we see our role in this field as one of assistance, cooperation and collaboration, when and where requested. The professional educators in our Office of Educational Programs and Services are working closely with organizations such as yours, with many of the National Education Association affiliates, with the U.S. Office of Education, the National Science Foundation, and with other national organizations and groups having an interest and responsibility in education.

We are utilizing our unique scientific and technical "in-house" sources of space information to develop materials for books, booklets, pamphlets and educational publications, in cooperation with practicing educator groups. We are making publicly available in useful form much of the exciting motion picture footage of our rocket launches, of the work on our scientific satellites, and of many other unusual and intriguing technological developments. We are a sole source for much of this type of information, and we are working diligently to make as much of it available as possible to classroom teachers and to adult groups across the nation and around the world.

We are assisting colleges and universities in organizing and conducting workshops and other programs designed to provide teachers at all age and grade levels with better understanding of space science and technology, and of the implications of our push into space -- socially, economically, and politically.

We are new and small in our educational services area but we already have initiated extensive and, we believe, effective liaison with State Departments of Education and with local officials and our NASA people are frequent speakers in space-oriented education meetings or programs in localities in all parts of the country. It will take more time than we yet have had to develop adequate articulation with all concerned in education, but it will be done.

One of our most successful educational service undertakings has been the so-called Spacemobile Program. This is a specially designed space science demonstration unit consisting of a transport vehicle, demonstration equipment and lecturers. The demonstration provides the school, college or lay audience with accurate, up-to-date information on space science and exploration. A typical demonstration is about 50 minutes long and answers six basic questions: What is a satellie? How does it get into orbit? What keeps it in orbit? What does it do? What good is it? and What are the plans for future research and exploration by the NASA?

We are now trying to meet Spacemobile demonstration requests with 10 units, operating on very tight schedules.

In the area of educational space exhibits we are currently booking units ranging from single cardboard panels to collections of full-scale models with supporting panels in order to contribute in this medium to NASA's mission to provide to the public the facts on our space programs. The exhibits activity is growing steadily and rapidly and is becoming international in scope.

We have space subject presentations on many TV programs -- on educational TV channels and on the regular commercial networks. In addition, we have under way development of a series of programs in space science and technology for use by the colleges and educational systems now on the national educational television network. We also are cooperating with the University Film Producers Association and many local TV stations in development of resources for use in educational television for schools and colleges. We are assisting the airborne television experiment and will continue to seek out ways of assisting various similar enterprises to enrich the teaching of science and the dissemination of facts about the national space program.

The NASA is considering proposals for assistance to sponsors of educational research projects in the elementary, secondary and college science areas. What will eventuate here in terms of actual program support and activity cannot yet be foreseen, although fruitful relationship to programs of merit have already developed with various educational organizations and professional societies.

This is indeed only a sketch of our efforts -- efforts which represent services to those who are concerned with the development of an increase supply of scientists, engineers, and technicians for future needs, and to achieve for our country a science-literate citizenry able to understand and act intelligently in the face of many problems emerging from an age of science and technology.

Now, in summary:

Space exploration has become a powerful societal force exerting great influence upon our present and future -- socially, economically, politically, and morally.

Whatever the schools may or may not do, our children are, and will be on an increasing scale, exposed to results of accelerated scientific advances and technical developments through newspapers, radio, television and word of mouth. They can, however, acquire adequate understanding of these societal forces only through an orderly intellectual experience. This orderly experience is the responsibility of the school.

Mr. Webb:

The National Science Foundation last month released a study of Soviet education prepared by Nicholas DeWitt, an associate at Harvard University's Russian Research Center. The Washington Post headline on the story covering the study was: "Soviets Veer Teaching to Science Primacy." The study pointed out that in the Soviet Union a high premium is placed upon technical and specialized, rather than general, excellence. Science and technology are particularly recognized as the foundation of national strength.

Dr. DeWitt states in a postscript to his 900-page study that: "If the aim of education is to develop a creative intellect critical of society and its values, then Soviet higher education is an obvious failure. If its aim is to develop applied professional skills enabling the individual to perform specialized, functional tasks, then Soviet higher education is unquestionably a success, posing not only a temporary challenge, but a major threat in the long-range struggle between democracy and totalitarianism."

This statement of Dr. DeWitt is worth pondering. If we assume it as unquestionable fact, the job ahead of us in education is indeed of immense proportions. Certainly we must not and, I trust, will not, diminish or dilute our national aim in education to develop a creative intellect and a citizen, well-rounded, well-grounded, and educated to live and appreciate an effective life. Yet, if to allow ourselves to be surpassed by totalitarianism in the fields of applied science and technology, means the eventual loss of democracy in the struggle for survival, we just cannot let it happen. Obviously, then, we must survive and continue to prosper by shear persistency, by exerting old-time American initiative, by achieving excellence in the physical sciences, yes, but also in the humanities, the arts, and the social and behavioral sciences.

My colleagues and I have attempted tonight to give you a briefing on the nation's space program, its impacts on the nation and upon our international relations, and then some of our thoughts on the implication of space exploration for education.

It has been a great pleasure and an opportunity for us to address you. In closing I quote Representative George Miller, Chairman of the House Space Committee, in a recent statement to the American Astronautical Society:

> "Our need to lead in space exploration is not merely a matter of space survival; it is not simply the result of a normal impulse to surpass our competitors, nor is it the result of a selfish desire for the yet undreamed of conveniences and luxuries which the mastering of space technology can create.
>
> "It arises from a broader and nobler purpose which has existed in the hearts and minds of men since the first human thought occurred -- the need to know, the need to grow, the desire for fulfillment of the ultimate destiny of mankind."